computability, etc., constitute network patterns of information flow of both invertible and noninvertible types supplied by a rainfall source of information that represents a noncompletable atmosphere that contains uncountable numbers of completably infinite sets of information bits. Obviously, the latter are not describable as such until they enter the flow, so the nature of actual versus potential states within the source is not definable.

### Is Cantor's Theory Useless?

I want to close this with a remark about the question of whether or not Cantor's theory may be meaningless because it again takes us to the issue of relationships (The last five paragraphs of the letter paraphrase thoughts with which I am in some sympathy, and I have nothing to add there.) My remark is to be taken as a statement of limited experience rather than as a point of logical inference. To me, it does not take probability theory to tell us that the outcomes of real measurements are transcendental ones. Yet, it is also easy to pretend that this is of no practical consequence when it comes to counting grains of sand in a sedimentary stratum, numbers of sandstone layers in a stratigraphic sequence, numbers of craters on the Moon, or numbers of markers on a dial. When one begins to ask, however, how the proportionalities relate to one another as functions of scale of observation, we are led, if not to Cantor's reasoning, at least to serious questions concerning distinctions between different infinite sets, computable numbers, etc. (or, analogously, to the possible meanings that might be attached to differing fractal similarity regimes of bounded sets).

Whatever one may say about Cantor, or about the generalizations of related notions involved in fractal geometry as developed by Mandelbrot, there has been a shift in the perceptions of the material scientists toward new methods of describing and recognizing complexity. It is clear from the kinds of comments I get from colleagues that to some persons these issues are as controversial today as they were in the nineteenth century when mathematicians such as Gauss and Dedekind were arguing about completed infinities vis a vis potential infinities. However, the notion introduced by Cantor concerning equivalence tests was a harbinger of methods now used by an increasing number of researchers in applying fractal singularity concepts to the description of material behavior involving chaotic trajectories of motion. Whether this is called success or failure of mathematical methods and whether or not it makes any sense at all may not be decidable by criteria other than subjective or authoritarian logic. Value judgments aside, these developments represent an evolutionary progression, and this is where my interest in the methods of nonlinear dynamics had their inception.

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# Books

## The Analysis of Extraterrestrial Materials

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Isidore Adler, *Chem. Anal. Ser.*, vol. 8, John Wiley, New York, xvii + 346 pp., 1986, $55.00

*Reviewed by Arden L. Albee*

As implied by its title, this book primarily concerns the actual analysis of extraterrestrial materials (including atmospheres and solar wind) rather than the results of such analyses. Five chapters deal with analysis of these materials in terrestrial laboratories, and six chapters describe remote analysis on spacecraft missions. Most chapters can be easily dated — they were written shortly after the mission, have undergone only sporadic updating, and are largely illustrated by copies of vu-graphs presented at National Aeronautics and Space Administration (NASA) briefings. This historical approach is quite successful in describing the original lunar receiving laboratory and instruments from specific missions. These chapters bring together good and readable descriptions of instruments from the Surveyor, Apollo, Viking, Pioneer, Venus, and especially the Soviet Lunakhod and Venera missions. The author participated in a number of the investigations involving gamma ray or X ray fluorescence spectrometry, and these sections are especially good. However, the chapters on meteorites, lunar samples, cosmochronology, and reflectance spectroscopy are too dated and should have been completely rewritten to properly convey current research and understanding.

The last chapter is a brief summary of 10 missions that NASA has studied as candidates for future flight. Unfortunately, the chapter simply lists various instruments as payloads for each mission. This chapter does not attempt to describe present instrumentation or future technological approaches that will be used to analyze extraterrestrial material in the future missions. Unhappily, this may leave the reader with the erroneous impression that instrumental techniques of the 1960s will be utilized in the planetary missions of the 1990s and beyond.

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